



EFFECT OF AUDIO-VISUAL TECHNOLOGICAL AIDS ON CHEMISTRY STUDENTS' ACHIEVEMENT IN SENIOR SECONDARY SCHOOLS IN NSUKKA EDUCATION ZONE OF ENUGU STATE, NIGERIA.

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ABSTRACT

The study examined the effects of audio-visual technological aids on chemistry students' achievement in senior secondary schools in Nsukka education zone of Enugu State, Nigeria. The study employed a pre-test-post-test, control group quasi experimental research design. Two research questions and two null hypotheses were formulated to guide this study. The population of the study comprises of all the SSI Chemistry students in public secondary schools in Nsukka education zone. The sample size was 100 SSI Chemistry students comprising of 48 male and 52 female students of two intact classes. Purposive sampling technique was used to select two co-educational schools which one were assigned to experimental group and other to control group. The instrument used for data collection was a 25-item Chemistry achievement test (CAT). Mean, Standard Deviation and ANCOVA were used for data analysis. Result revealed that the mean score for the Chemistry students exposed to lessons with audio-visual technological aids achieved higher compared to the mean score of those counterpart not exposed to lessons with audio-visual technological aids. The study recommended that Chemistry teachers should keep pace with development trend by learning and using new technologies (audio-visual) in teaching and learning.

Keywords: Achievement, Audio-Visual Aids, Chemistry, Senior Secondary Students

INTRODUCTION

Chemistry is one of the most important branches of science dealing with the composition, structures and properties of matter, the interactions between different types of matter and the relationship between matter and energy. Many of our day-to-activities revolve around chemistry. Chemistry is everywhere; chemistry is life; chemistry is the oracle of modern science (Cabuil, 2011). Chemistry teaching should involve creative ways of integrating the acquisition of self-reliant skills and the learning activities of the learner in the classroom (Igboegwu & Ikokwu, 2012). Also, chemistry is a critical determinant of the post



secondary education and career options available to young people in the sciences (Nnaka, 2010). The importance of chemistry according to Ezeliora (2009) is the mirror of civilization in all the centuries of development and the most basic discipline for any person who would be truly educated in any science and in many other endeavours. In addition, Ezekannagha and Ifeakor (2005) pointed out that the functional role of chemistry in science and technology is so many that no area of business enterprise, science and technology escapes its application.

The significance of science and technology and its developmental endeavours have been recognize nationwide. Basic knowledge in science is essential for all forms of modern development. To be able to appreciate, control and effectively tap from and utilize the resources of the natural environment, it is imperative to acquire scientific knowledge which is a basic tool for all forms of industrial and technological advancement of any nation. Onu (2017) asserts that no nation can become great, without science and technology. This expression of the need for science and technology according to Ibe, Nwosu, Obi & Nwoye, (2016) have become an integral part of world's culture. Hence, the need to keep pace with the global development in science and technology. Science is a dynamic human activity concerned with understanding the working of our world. This understanding helps man to know more about the universe. In order to guarantee the understanding of man of his environment, it becomes imperative to re-examine the quality of our science education, particularly chemistry as a popular science subject that students' performance has been on the decline.

Despite the importance placed on chemistry, it is very disappointing to note that students' performance in the subject at both internal and external examinations has remained consistently poor (Udo & Eshiet, 2007). Reports show that mass failure in chemistry examination is real and the trend of students' performance has been on the decline (Udofia 2008). The situation has been fluctuating, yet persistently under average achievement of students. This poor achievement is not different from WAEC record in Enugu state and Nsukka local government Area of Nigeria. This problem has continued to generate several research concerns among stake holders on the underlying factors responsible for, as well as possible ways to combat this poor trend of poor achievement. Several factors have been adduced for the poor achievement. Idoko and Njoku (2017) reported poor laboratory facilities, and poor pedagogical characteristics of teachers. Neji (2011) reported learner's personal characteristics. Authors like Okpala (2021) and Uduchukwu (2010) lamented that teaching Chemistry in secondary schools is defective. This has posed a lot of threat to students that have passion to undertake science courses that have Chemistry as prerequisite requirement for entrance to tertiary institutions. Besides the problem of poor achievement in secondary school Chemistry, the common practice in Nigeria secondary school is that most of the students choose Chemistry as one of the science subjects that will qualify them to further science discipline and not because they are interested in the subject.



Poor performance in chemistry which also emanates from lack of interest, anxiety and phobia has been observed by Aprebo (2002) to be an academic problem which has not yet been fully diagnosed for effective treatment. These lack of interest, anxiety and phobia are usually expressed on the faces of chemistry students in their classes because of a number of learning difficulties they are passing through. Aprebo further pointed out that the negative effect of the anxiety and phobia is spread to all other subjects that relate to chemistry. The West African Examinations Council (WAEC) Chief Examiner's Report (2010) suggested that students' performance in chemistry could be improved through meaningful and proper teaching. According to the report, teachers should reduce the abstractness of chemistry, control the apathy and fear of the subject, and enhance students achievement in Chemistry.

Achievement in the teaching and learning process has to do with attainment of set objectives of instruction (Nbina & Obomanu, 2011). Studies have shown that the teaching of science in Nigerian secondary schools falls short of the standard expected of it. Most of the methods used in science teaching have been described as inappropriate and uninspiring (Ibe, 2004; Madu, 2004; Shaleigh, 2004). Nnaobi (2007) asserts that there is no best method of teaching but that effective scientific teaching should be laboratory-centred, activity-oriented and technologically oriented rather than textbook or lecture-dominated methods which seem to characterize the Nigerian schools. These effective scientific teaching methods are innovative teaching strategies and methods used to enhance teaching and learning. Several innovative methods have been tried out and students still achieve poorly in Chemistry. These underscores the need of trying out an innovative teaching strategy and technique that lends itself to present age globalization; exploring ways audio visual technological contents/materials can impact on achievement of students in Chemistry who live in an information, communication and technological age.

Audio visual is an indispensable tool for teaching and learning as its absence could make learning incomplete and ill-equip for the students to learn effectively in our modern age of science and technology. Audio-visual instructional materials in teaching are those image and sound in addition to textual information. Audio visual materials are those materials that appeals to the sense of seeing and hearing simultaneously. Audio visual instructional material add life to learning experiences, as images and animations make words easier to comprehend and remember. According to Anzaku, (2011) the term audio-visual resource is commonly used to refer to those instructional materials that may be used to convey meaning without complete dependence upon verbal symbols or language. Audio-visuals are tool used to facilitate the learning experience of the individual and to make it more realistic and dynamic (Kinder, 2012). In teaching and learning, the use of audio-visual resources proves to be better instructional aids and according to Mgbodile (2009) it yields good result in all domains of learning, that is: the cognitive, effective and psychomotor domains respectively. The audio-visual materials give the students the opportunities to take the instruction in its original form instead of abstract. It is of importance to note that the basic aim of education must be to lead students towards self-



learning and life-long learning and this aim can be achieved through the use of audio-visual instructional material as it improves the learning capacities of individual students i.e. learning experience that is worth memorable (Singh, Sharma, Upadhy, 2012). Audio-visual is the group that consists of a combination of both audio and visual materials. They are therefore materials like television films and projector etc, the use of these enhances teaching and learning.

Teaching and learning of Chemistry in this modern period is increasingly becoming more complex to be effectively actualized with traditional tools alone. The development in modern technology has made available a wide range of instructional materials to supplement teachers' efforts in teaching and learning process (Anyanuwu, 2003). Yet, teaching with instructional materials, especially with the newer technologies (audio-visual) that suit today's information technological society, is the trend in the contemporary society. This implies that the gradual shift towards the use of instructional materials in education has been encouraged by increased availability of effective, appropriate and convenient materials. Devices, machines and classroom facilities designed for improving instructional materials are equipment which are employed with the sense and sight. The use of audio-visual aid therefore become a necessity to supplement the available instructional resources and enhance students academic performance.

According to Youcef (2017), male and female learners have different styles of learning. Youcef, opined that male learners tended to be extroverts and prefer to work in groups while females tend to be introverts and prefer to work individually. This may be one of the reasons why there are different views concerning gender and achievement in Chemistry. Fatokun, Egya & Uzoechi (2016) reported that Chemistry students' achievement is not influence by gender. Contrarily, Anioch (2014) asset that female students performed better than male students while Arsaythamby, Lee & Lee (2015) contend that male students achieve significantly higher than the females in Chemistry. It is therefore, necessary for Chemistry teachers to employ innovative teaching methods that will be effective for both male and female students. Audio-visual technological aids could be an effective teaching method to enhance the performance of all students. This study, therefore investigates the effect of audio-visual technological aids on chemistry students' achievement in senior secondary schools in Nsukka Education Zone of Enugu State, Nigeria.

The purpose of the study was therefore to ascertain the effect of audio-visual technological aids on students' achievement in Chemistry. Specifically, this study investigated the:

- i. effect of audio-visual materials on achievement of students in Chemistry;
- ii. influence of gender on achievement of students in Chemistry and the interaction effect of teaching method and gender on achievement of students in Chemistry.

RESEARCH QUESTIONS

The following two research questions were posed to guide this study:



1. What are the mean achievement scores of students taught Chemistry using Audio-visual technological aids and those taught with conventional method?
2. What are the mean achievement scores of male and female students taught Chemistry?

HYPOTHESES

The following null hypothesis were tested at 5% level of significance.

- Ho₁: There is no significant difference between the mean achievement scores of students taught Chemistry with audio-visual technological aids and those taught with conventional method.
- Ho₂: There is no significant difference between the mean achievement scores of male and female students in Chemistry.

METHOD

The study was carried out in Nsukka Education Zone of Enugu state in Nigeria. The study employed a pre-test-post-test, control group quasi experimental research design. Two research questions and three null hypotheses were formulated to guide this study. The population of the study comprises of all the SSI Chemistry students in public secondary schools in Nsukka education zone. The sample size was 100 SSI Chemistry students (48 male and 52 female students) who were pretested before the commencement of the study after permission had been obtained from the school authority. The study lasted for six (6) weeks. Week 1 was used for training Chemistry teachers of the experimental schools on the conduct of the study using u-tube downloaded video on nature of matter-separation techniques while the Chemistry teachers in the control group schools was given lesson notes that guided their teaching. The Chemistry teachers in both the experimental and control group administered the two instruments to the students as pretest. Weeks 2, 3, 4 and 5 were used for the instructions. The instrument used for data collection was a 25-item Chemistry achievement test (CAT). The items were developed by the researchers and validated by three experts in Chemistry Education and Measurement and Evaluation from ESUT and AE-FUNAI respectively. The instrument was administered to 25 Chemistry students who were not part of the study to obtain a reliability of 0.79 with Kuder-Richardson Formula 20. Mean, Standard Deviation and ANCOVA were used for data analysis.

The Chemistry teachers in the sampled schools assisted in conduction the research. Prior to the experiment the instrument was given to both the control and experimental groups to respond as pre-test. After that, the students were subjected to treatments which lasted for four weeks. Chemistry students in the experimental group were taught using audio-visual technological aids during lesson activities and those Chemistry students that served as control group were taught using conventional method during the lesson activities. After the teaching exercise, the instrument was given to both groups as post-test. The scores from pre-test and post-test were collated and analysed to answer the research



questions with the use of mean and standard deviation. Analysis of covariance (ANCOVA) was used to test the null hypotheses were tested at 0.05 level of significance.

RESULTS

The results are presented in tables according to research questions and null hypotheses that guided the study.

Research Question One: What are the mean achievement scores of students taught Chemistry using audio-visual technological aids and those taught with conventional method?

Table 2: Groups' Mean Scores in Achievement Test in Chemistry

Group	N	Pre-test		Post-test		Gain Score	Gain Difference
		Mean	SD	Mean	SD		
Experimental Group	48	35.83	6.66	75.12	10.11	39.29	21.10
Control Group	52	35.50	6.67	53.69	10.81	18.19	

Table 1 shows that students taught Chemistry using Audio-visual materials had a pretest and posttest mean achievement scores of 35.83 and 72.12 with a mean gain of 39.29 while their counterpart in the control group had a pretest and posttest mean achievement scores of 35.50 and 53.69 with a mean gain of 18.19. The pretest mean scores of 35.83 and 35.50 in both the experimental and control groups indicated a uniform take-off for both groups without the intervention role of audio-visual technological content. The Standard Deviation score in the posttest for Experimental group was 10.11 while the control group had an SD of 10.81. The low standard deviation showed how compact students' scores clustered around the mean. Student taught using audio-visual materials achieved better than their counterparts taught Chemistry using conventional method.

Hypothesis One: There is no significant difference between the mean achievement scores of students taught Chemistry with audio-visual technological aids and those taught with conventional method.

Table 3: Summary of Analysis of Covariance (ANCOVA) of the effect of Audio-Visual Technological Aids on Students' achievement in Chemistry

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	118485.030 ^a	4	2871.258	25.372	.000	.517
Intercept	14544.273	1	14544.273	128.520	.000	.575



PretestInt	9.511	1	9.511	.084	773	.001
Method	11200.574	1	11200.574	98.973	.000	.510
Gender	8.338	1	8.338	.074	.787	.001
Method * Gender	3.773	1	3.773	.033	.856	.000
Error	10750.930	95	113.168			
Total	431580.000	100				
Corrected Total	22235.960	99				

Table 3 indicates that F-value of 98.973 with associated probability (2- tailed) ($p = 0.000$) is less than the significance level of 0.05. Since the probability value of 0.000 is less than 0.05 level of significance, the null hypothesis of no significance difference is rejected. Therefore, there is a significant difference between the mean achievement scores of students taught Chemistry with Audio-visual technological aids and those taught with conventional method.

Research Question Two: What are the mean achievement scores of male and female students taught Chemistry?

Table 4: Mean and Standard Deviation of Male and Female Students' Achievement in Chemistry

Group	N	Pre-test		Post-test		Gain Score	Gain Difference
		Mean	SD	Mean	SD		
Male	48	34.74	6.59	64.37	15.24	29.63	11.44
Female	52	36.35	6.74	63.68	14.91	18.19	

The data in Table 4 reveals a post-test mean achievement scores of 63.68 for the females, while the male students had a post-test mean achievement score of 64.37. Data also reveal that the pretest mean scores of both male and female students did not vary (6.59 and 6.74) appreciably. Males therefore, had slightly higher post-test mean achievement score when compared to their female counterparts in Chemistry. Females had a mean gain of 18.19 while males had a mean gain of 29.63. Females had an standard deviation of 14.91 while males had 15.24. However, the corresponding hypothesis reveals if the difference is substantial.

Hypothesis Two: There is no significant difference between the mean achievement scores of male and female students in Chemistry.

In order to test this hypothesis, the data collected from the Chemistry Achievement Test (CAT) was subjected to analysis of covariance (ANCOVA). the result obtained presented in Table 3. Table 3 reveals that F-ratio for gender is 0.074 and its significant at



0.787 which is higher than 0.05 level of significance. The null hypothesis was rejected. This implies that the mean achievement of Chemistry students did not differ significantly according to gender.

DISCUSSIONS

With respect to research questions one, students' taught using audio-visual technological aids achieved better than their counterparts taught Chemistry using conventional method. The corresponding hypothesis indicates a significant difference between the mean achievement scores of students taught Chemistry with audio-visual technological aids and those taught with conventional method. This finding supports the finding of China and Dada (2013) who found that students taught using video-instructional package achieved better in Chemistry than their counterpart taught using the conventional method. Audio-visual group students was superior in achievement test scores because students were given time to bring upon the learning process their senses - seeing, hearing and touching. Chemistry students in the instructional processes raised questions in their groups. Attempts were also made by peer interactions within groups and between groups in resolving bottlenecks while the teacher's role was guidance oriented. The teacher asked probing questions that elicited explanations and answers of students questions as the slides of the video were displayed. These helped in driving home salient points and removed abstractions. For research question two, although males had slightly higher posttest mean achievement score than females, the corresponding hypothesis shows that there is no significant difference between the mean achievement scores of male and female students in Chemistry.

CONCLUSION

The study concludes that effective use of audio-visual technological aids in teaching and learning process, enhances students achievement in Chemistry. Teaching and learning using the new audio-visuals materials and other technological aids will provide a way forward for our country (Nigeria) in joining and catching up with the developed nations that Science and Technology has become their dominant culture.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made:

1. Chemistry teachers should be trained on how to use audio-visual technological aids in teaching and learning.
2. Curriculum planners should encourage and integrate the use of audio visual materials in the curriculum for teaching and learning of Chemistry since it involves students actively participating in the lesson and manipulating the learning equipment.
3. Teachers should endeavor to use audio-visual material during teaching and learning of Chemistry.



4. Government should make these audio visual materials gadgets readily available for teachers to use as well as students during teaching and learning.

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